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Preterm Infants Show Reduced Stress Behaviors and Activity after 5 days of Massage Therapy

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Abstract

Preterm infants residing in an NICU were randomly assigned to a massage therapy or to a control group. The preterm infants in the massage therapy group received three 15 minute massages each day for 5 consecutive days, with the massages consisting of moderate pressure stroking to the head, shoulders, back, arms and legs and kinesthetic exercises consisting of flexion and extension of the limbs. Infant stress behaviors and activity were recorded on the first and last day of the study. Preterm infants receiving massage therapy showed fewer stress behaviors and less activity from the first to the last day of the study. The findings suggest that massage has pacifying or stress reducing effects on preterm infants, which is noteworthy given that they experience numerous stressors during their hospitalization.

Keywords

Preterm infants; massage; activity; stress behaviors

Over two decades of research have shown that massaging stable preterm infants while residing in the neonatal intensive care unit (NICU) leads to greater weight gain and earlier discharge (Dieter, Field, Hernandez-Reif, Emory & Redzepi, 2003; Field, Schanberg, Scafidi, Bauer, Vega-Lahr, Garcia, Nystrom & Kuhn, 1986; Scafidi, Field, Schanberg, Bauer, Tucci, Roberts & Kuhn, 1990). Replication studies report similar massage benefits for preterm infants across the US, Asia and Europe (for a review see Field, Hernandez-Reif & Freedman, 2004). A recent mechanism study suggests that the weight gain observed in preterm infants who receive massage is related to increased vagal activity and greater gastric motility (Diego, Field & Hernandez-Reif, 2006), which are associated with parasympathetic nervous system activity and the attenuation of the stress response.

Massage therapy as an intervention that enhances growth and simultaneously reduces stress would be cost-effective given that preterm infants show disorganized physiological and behavioral responses associated with the daily stressors of hospitalization and medical procedures (Anand, Johnston, Oberlander, Taddio, Tutag Lehr, & Walco, 2005). Reducing preterm infants' stress is of particular concern because in the animal and human model repetitive stress has been associated with adverse effects on the neurodevelopment of the neonate (Grunau, Oberlander, Whitfield et. al, 2001; Mitchell & Boss, 2002).

A review of the preterm infant literature revealed mixed findings, with some infants showing greater activity with massage and others showing no change in activity (Barnard & Bee, 1983; Scafidi, Field, Schanberg, Bauer, Vega-Lahr, Garcia, Poirier, Nystrom & Kuhn, 1986; Solkoff, Yaffe, Weintraub & Blasé, 1969). The mixed findings may be attributed to different timing periods (pre, during, post massage) or different methodologies for reporting activity. In one controlled study that used time-lapse videotape and live observations, preterm infants who received massage showed greater activity when receiving a massage than during an observation period without massage (Scafidi, et al., 1990). The Scafidi et al., (1990) study suggests that massage therapy may have immediate effects on preterm infants' activity. However, it is unclear whether daily massages have cumulative effects and reduce preterm infants' activity levels or stress behaviors.

In the current study, we assessed the cumulative effects of 5 days of massage therapy (3 massages a day or a total of 15 massages) on preterm infants' activity and stress behaviors using a randomized-controlled group design. Five days of massage was chosen because recent studies by our group have found this time frame to be effective for improving preterm infant growth and development (Dieter, et al., 2003; Diego, et al., 2005). This study differed from the Scafidi et al., (1990) study by focusing the observation on a baseline period when no massage was provided. If massage therapy facilitates parasympathetic function and reduces stress responses and the effects are cumulative, then preterm infants would be expected to be less active and show fewer stress behaviors from the first to the last day of the study.

METHOD

Participants

Consent and Screening Process—Attending physicians at a large urban university Neonatal Intensive Care Unit (NICU) referred medically stable preterm infants who met the study criteria, which included a) gestational age between 28 and 32 weeks, b) birthweight between 800 and 1,400 gms, and c) NICU hospitalization between 15 and 60 days. These criteria follow those of other preterm infant massage studies (see Field, et al., 1986). Mothers of the preterm infants were approached about the study when they visited their infants at the NICU. They were informed of the randomization procedure and the details of the study and if they agreed to these, they were asked to sign a written informed consent and HIPPA form (Health Insurance Portability and Accountability Act) approved by the University's Institutional Review Board. After obtaining consent, infants' medical charts were reviewed for exclusion criteria, which included: a) genetic anomalies, congenital heart malformations, and/or central nervous system dysfunction, b) HIV infection, c) maternal history of alcohol or illicit drug exposure, syphilis or hepatitis B, or d) infant surgery.

A total of 36 preterm infants who met criteria participated and were randomly assigned to the massage or control group. Of the 36 preterm infants tested, 32 infants provided usable data (16 massage and 16 control). Data were lost for 4 infants (2 massage and 2 control) due to equipment malfunction. Additionally, data were lost for one additional infant (control) due to experimenter error when saving the stress data; fortunately, the activity data for that infant were saved. Demographic data for the two groups are provided in table 1.

Treatment Groups

The massaged infants received three 15-minute massages administered at 9 am, 11 am and 1 pm each day for 5 consecutive days. The massages were started on a Monday and ended on Friday of the same week, for a total of 15 massages. The preterm infants received their massages from licensed massage therapists who were trained on a structured protocol that included, 1) with the infants in a prone position, applying moderate pressure stroking to the head, shoulders,

back, legs and arms for 5 minutes, 2) kinesthetic stimulation consisting of flexing and extending the limbs in a supine position for the next 5 minutes, and 3) returning the infant to the prone position and repeating the moderate pressure massage stroking sequence for the last 5 minutes (same as the 1st 5 minutes). Details of the massage protocol, including the timing of the strokes, are reported in several papers by our group (Diego, et al., 2006; Dieter et al., 2003; Field et al., 1986; Scafidi et al., 1990).

The control group did not receive massage therapy. Both groups received standard NICU care as prescribed by their attending physicians.

Behavior Observations

Researchers blind to the infant's group assignment and trained to .90 criterion for interobserver reliability recorded at bedside the duration of infants' stress behaviors and activity (movement) for 15 minutes on the first and the last days of the 5-week study. The observations were conducted in the morning of the first and last day of the study for both groups. The stress behaviors coded included: crying, grimacing, yawning, sneezing, jerky arm or leg movements, startles, and finger flaring. Activity was recorded simultaneously as movement of the limbs, torso or gross body movement of any kind. The recordings were made on a computer laptop with key strokes operated by the researcher on a customized computer program (Guthertz & Field, 1989) that tabulated the number of stress behaviors and the duration of movement/activity behavior over the sampling period. At the end of the session, the data for each infant were summarized in a matrix and transferred to a spreadsheet for later group analyses.

Results

The background and demographic data were examined using ANOVA and *Chi-square* analyses to assess equivalence between the groups. The two groups did not differ on any variable (see Table 1).

Stress Behaviors

The stress data (% time showing stress behaviors) were analyzed using a group (massage, control) by time (first, last day) repeated measures ANOVA. The analysis yielded a significant group by time interaction effect, $F(1, 29) = 4.81, p < .05$, revealing a reduction in duration of stress behaviors from the first to the last day of the study for the massage group (M 1st day = 8.1; $sd = 3.5$ / M last day = 5.9; $sd = 2.8$) and no change for the control group (M 1st day = 7.2; $sd = 4.2$ / M last day = 7.8; $sd = 3.8$) (see Figure 1).

Activity

The activity data (% movement) were also analyzed as above as a repeated measures ANOVA. The analyses revealed a significant group by time interaction effect, $F(1, 3) = 6.11, p < .05$, suggesting a long term reduction in overall movement for the massage group from the first to the last day of the 5 day study (M 1st day = 33.8; $sd = 13.7$ / M last day = 21.7; $sd = 11.0$). No reduction in activity was observed for the control group (M 1st day = 24.3; $sd = 15.9$ / M last day = 24.3; $sd = 11.0$) (see Figure 1).

Discussion

Preterm infants are exposed daily to numerous stressors while being treated in the Neonatal Intensive Care Unit (NICU), resulting in their display of heightened motor activity and stress behaviors (Anand, 2005). Attenuation of these stress behaviors is desirable since chronic exposure to stress has been associated with medical and neurodevelopmental problems in the neonate (Grunau, et al., 2001; Mitchell & Boss, 2002). The current study examined the

cumulative effects of massage therapy (three massages a day over 5 days) on medically stable preterm infants being treated in an NICU. The preterm infants who received the massages were expected to show reduced stress behaviors and activity since massage therapy is associated with relaxation (Field, 1998) and decreased anxiety in adults (Field, Diego, & Hernandez-Reif, 2006) and reduction of cortisol levels, in both infants (Field, et al., 1996) and preterm infants (Alcolet, et al., 1993).

As expected, the massaged preterm infants were less active and showed fewer stress behaviors from the first to the last day, suggesting that over time massage therapy has a stress reducing or pacifying effect. These findings may also suggest that massage therapy desensitizes the preterm infant to the stressful environment of the NICU perhaps by enhancing longer periods of parasympathetic activity, as has been documented in a study by our group that showed increased vagal activity associated with the same massage protocol (Diego, Field, & Hernandez-Reif, 2006). Although additional studies on larger samples and over extended periods are necessary, the findings suggest that as little as 15 minutes of moderate pressure massage three times a day for 5 days may promote behavioral organization in medically stable preterm infants. Because of the simplicity and brevity of the massage, parents could be trained to massage their infants during their hospital visits and after leaving the hospital. This would make the massage therapy even more cost- and time-effective.

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**Stress Behaviors on the First and Last Days
for the Massage vs the Control Group**

**Movement on the First and Last Days
for the Massage vs the Control Group**

Figure 1.

Table 1

Preterm infant demographic and background characteristics (standard deviations under means in parentheses).

	GROUP		
	Massage	Control	p-value
Gestational Age	29.19 (2.04)	29.88 (2.63)	<i>N.S.</i>
Birth weight (gms)	1176.56 (244.95)	1346.25 (360.56)	<i>N.S.</i>
NICU days	34.25 (17.43)	32.88 (21.13)	<i>N.S.</i>
Gender			
Male	25.00%	31.30%	<i>N.S.</i>
Female	75.00%	68.80%	
Ethnicity			
Hispanic	68.80%	68.80%	<i>N.S.</i>
Black	31.30%	31.30%	

Note: N.S. = not significant ($p > .05$)